

HEAT EXCHANGER POLYMERIZATION REACTORS FOR MANUFACTURING DRAG REDUCING AGENTS

Cross-References to Related Applications

- 5 [0001] This application is a continuation-in-part of U.S. Serial No. 10/373,361 filed February 24, 2003. *Pending*

Field of the Invention

- 10 [0002] The invention relates to methods and apparatus for preparing polymers, and most particularly relates, in one non-limiting embodiment, to methods and apparatus for preparing polymers where the polymerization temperature is controlled to thereby produce higher quality polymers, such as those useful as drag reducing agents.

Background of the Invention

- 15 [0003] The use of polyalpha-olefins and copolymers thereof to reduce the effect of friction ("drag") experienced by a liquid hydrocarbon flowing through a hydrocarbon transportation pipeline is well-known in the art. Reduction of the drag decreases the amount of energy needed to accomplish such flow, and therefore also decreases the costs associated with pumping. These materials, often called drag reducing agents (DRAs), can take various forms, including certain polymers in oil soluble suspensions, emulsions, pellets, gels, microfine powders and particulate slurries. However, particulate slurries that comprise ground polymers are often the least expensive form. The ultimate goal is a DRA that rapidly dissolves in the flowing hydrocarbon and that has a polymer content sufficient to ensure that the desired level of drag reduction is achieved.
- 20 [0004] The polymers that are most commonly used in preparing DRAs are polyalpha-olefins of carbon chain lengths ranging from 2 to about 40. Typically these polymers are prepared using Ziegler-Natta catalysts and frequently also co-catalysts such as alkyl aluminum compounds. These polymerization reactions tend to be very efficient, producing relatively high yield when carried out in bulk. However,
- 25 30